

## Electrochromic Properties of Poly(ethylene oxide)/V<sub>2</sub>O<sub>5</sub> Nanocomposite Films

W. Chen, Q. Xu and Y. S. Hu  
Institute of Materials Science and Engineering,  
Wuhan University of Technology,  
Wuhan 430070 Hubei, People's Republic of China

**Keywords:** Electrochromism, PEO/V<sub>2</sub>O<sub>5</sub> nanocomposite films, Lithium insertion.

It is well-established that some inorganic layered compounds acting as hosts can be intercalated by a variety of alkali ions (Li<sup>+</sup>, Na<sup>+</sup>, etc.), atoms, molecules and larger molecules as guests to form intercalation host-guest compounds which are expected to be used as potential cathodic materials in secondary lithium batteries and electrochromic devices as a result of their desirable characteristics<sup>[1]</sup>. Vanadium oxide xerogel in particular are unique among sol-gel-derived materials because they possess the layered structure and they are capable of host-guest intercalation chemistry with a variety of species.

In this paper the preparation of poly(ethylene oxide) (PEO)/V<sub>2</sub>O<sub>5</sub> nanocomposite films and the relationship between optical, electrochemical and mechanic behavior of the nanocomposite films is reported and discussed. The PEO/V<sub>2</sub>O<sub>5</sub> nanocomposite films were prepared by PEO intercalation into V<sub>2</sub>O<sub>5</sub> xerogel interlayer in sol-gel route. Lithium insertion was performed by electrochemical means in a non-aqueous lithium cell using 1M LiClO<sub>4</sub> dissolved in propylene carbonate (PC) electrolyte. The cyclic voltammograms and spectral transmittance of the nanocomposite films were measured. The results show that the reversibility of insertion/exertion of Li<sup>+</sup> ions is improved with the intercalation of PEO into V<sub>2</sub>O<sub>5</sub> interlayer. It is assumed that Li<sup>+</sup> ions have the complexing action with the PEO and PEO is bound with V<sub>2</sub>O<sub>5</sub> in H-bonding form<sup>[2]</sup>, which is effectively shielded the electrostatic force between V<sub>2</sub>O<sub>5</sub> interlayer and Li<sup>+</sup> ions. Thus, it is improved the reversibility of insertion/exertion of Li<sup>+</sup> ions in V<sub>2</sub>O<sub>5</sub> interlayer. After Li<sup>+</sup> ions are incorporated in the nanocomposite films, the spectral absorption edge shifts to lower wavenumber. Near ultraviolet transmittance is increased and near infrared transmittance is fallen. The nanocomposite films present the anodic electrochromic and weak cathodic electrochromic characteristics.

### References:

- [1] V. Mehrotra and E. P. Giannelis, J. Appl. Phys., 3 (1992)1039.
- [2] S. G. Shan, D. S. Gao, W. Chen and R. Z. Yuan, J. Wuhan Univ. Techol.-Mater. Sci. Ed., 15(2000)1